Resumé

The initial goal of the thesis was to nd out the ability of pupils to understand the text of additive word problems, grasp their objects and relations, distinguish numerical data in the function of states and operators, solve such word problems, correctly interpret acquired results, but also to detect possible obstacles to solving or reasons for a pupil's failure in order to draw methods how to eliminate them. After realizing some pre-experiments the goal was shifted to a qualitatively higher level { to investigate the level of an individual's operator thinking via specic word problems, additive word problems with operators, and to design possible ways how to develop a scheme of an individual's operator thinking. For illustrating our research tool we present an example of word problems of a conceptual character and a situation of a procedural character both containing only operators. Bob is 13cm taller than Adam. Chris is 4cm shorter than Bob. Compare the height of Chris and Adam and say how many cm Chris is taller or shorter than Adam. In January the price of a coat was reduced by 500 Sk. Then in February the price rose by 800 Sk, but in March it went down again by 600 Sk. For our purpose we used the assigned word problem for pupils in dierent research methods, such as interview, tests, transfer (based on free paraphrasing an assigned word problem by a pupil to his/her schoolmate) and for students the situation with the appeal to complete the situation by forming a question, which is part of the activity called problem posing, and then solve it. From 2003 to 2008 we realized 8 experiments with 157 9{12-year-old pupils and 131 students, mainly pre-service elementary teachers. We analyzed their solving processes using qualitative methods, mainly Comparative Analysis and Atomic Analysis (Hejný, 1992). While doing the cognitive analyses we took advantage of some concept development theories { the Theory of Generic Models (Hejný, 2003), Procedural and Conceptual Knowledge in Mathematics (Hiebert, Lefevre, 1986) and the Procept Theory (Gray, Tall, 2001). Research ndings show there are three basic levels of a solver's ability of operator thinking:

1. A state is dominant; an operator depends on state presence.
2. An operator is dominating, but a state is helpful to operator considerations.
3. An operator is able to exist independently on states.

Developing the scheme of operator thinking via word problems with operators is based on weakening states if they are required by a solver and putting the accent on operators. Dierent possible ways how to reach the higher level of operator thinking are described in detail in the thesis. In simple terms using the appropriate context successful educational strategies following from existing researches are oriented on modelling situations by means of dramatisation, simulative dramatisation, games, visualisation, creating schemes, graphs, tables and overviews. During the research we found some questions and problems drawn as a possible continuation of the work in conclusion.